REMARKS

Overview of the Office Action

Claims 1-21 and 27-47 have been rejected under 35 U.S.C. §103(a) as unpatentable over U.S. Patent No. 6,687,209 ("Ota") in view of U.S. Patent No. 6,717,906 (Shimano).

Status of the claims

Claims 1, 9-11, 15, 21, 28, 33, 36, and 42 have been amended.

Claims 22-26 have been previously canceled.

Claims 17-20, 34, 35, 38, 39, 41, 43, 44, and 47 have now been canceled.

Claims 1-16, 21, 27-33, 36, 37, 40, 42, 45, and 46 remain pending.

Interview Summary

Applicants' representative, Bradley M. Marazas, and Examiner Van M. Chow conducted a telephone interview on May 1, 2009, which is memorialized in an Interview Summary issued by the Examiner on May 5, 2009. During the interview, Applicants' representative proposed various amendments to the claims to overcome the cited references. The Examiner agreed that none of the currently cited references teach or suggest Applicants' proposed additional limitation of "wherein the optical path difference giving structure is superimposed on the diffractive structure so that at least one stepped shape of the optical path difference giving structure is disposed on the optical surfaces of each of the plurality diffracting ring-shaped zones".

The Examiner however did not agree that the cited references fail to teach or suggest the subject matter of dependent claims 9 and 15, which Applicants also proposed adding to claim 1. Specifically, the Examiner indicated that the significance of the first wavelength $\lambda 1$ satisfying 370

nm $\leq \lambda 1 \leq$ 430 nm and the second wavelength $\lambda 2$ satisfying 620 nm $\leq \lambda 2 \leq$ 680 nm was not understood.

Rejection of claims 1-21 and 27-47 under 35 U.S.C. §103(a)

The Office Action states that the combination of Ota and Shimano teaches all of Applicants' recited elements.

Before discussing the cited prior art and the Examiner's rejections of the claims in view of that art, a brief description of the subject matter described in the present application is deemed appropriate to facilitate understanding of the arguments for patentability. The description is not meant to argue unclaimed subject matter.

According to Applicants' recited invention, the objective lens 10 an optical surface that includes a central region arranged around the optical axis and formed in an approximately circular shape, and a peripheral region arranged at a periphery of the central region. The objective lens 10 further includes a diffractive structure 20 in the central region, which has a plurality of blade-shaped diffracting ring-shaped zones 21. The optical surface of each diffracting ring-shaped zone 21 of Applicants' recited invention is formed to arrange a structure 22 that has a diffracting function in the diffractive structure 20. Applicants' recited objective lens 10 also includes an optical path difference giving structure 30 in the central region, which forms a stepwise discontinuous surface composed of a plurality of divided surfaces 31, and which provides a prescribed optical path difference for a light beam passing through each structure 22 having a diffracting function (see paragraph [0205] and Figs. 2 and 3C of Applicants' specification).

Further, the diffractive structure 20 and the optical path difference giving structure 30 are both provided in the region A1 (see Fig. 2) to superimpose the diffractive structure 20 and the

optical path difference giving structure 30, so that at least one stepped shape of the optical path difference giving structure 30 is disposed on the optical surfaces of each of the plurality of diffracting ring-shaped zones 21 (see Figs. 3A, 3C, 5, 6, 7, 11, 12A, 12B, 13, 14, 15, 16, and 17 of Applicants' specification and also see Fig. A attached to this Amendment).

Because the diffractive structure 20 and the optical path difference giving structure 30 are superimposed, the functions of both these elements are also superimposed when applied to light flux passing through the section of objective lens 10 that is inside and at the boundary of the optical surface 10a. Specifically, not only is the phase difference between the area equipped with the diffractive structure 20 and an area without a diffractive structure 20 reduced, but the diffraction efficiency of the light flux passing through the diffracting ring-shapes zones with the superimposed diffractive structure 20 and optical path difference giving structure 30 is improved. In other words, the objective lens can obtain the sufficient amount of light according to the kind of optical information recording medium because a light flux having an wavelength $\lambda 1$ and a light flux having an wavelength $\lambda 2$ are output to a first and a second optical information recording media at high diffraction efficiencies, respectively (see paragraph [0222] and FIG. 4 of Applicants' published specification).

The purpose of the present invention is to provide a lens that can be used for two different types of optical information recording media. As explained in the Background section of the present application, DVDs use a laser that produced 650 nm wavelength light. Other high intensity DVDs use light having a wavelength of about 400 nm. Fig. 8 shows that the diffraction efficiency is very different for the two different wavelengths thereby causing a problem in that light converged on one of the two types of disks (DVD and high intensity DVD) is insufficient when one prior art lens is used (see paragraph [0013]-[0014] of the Applicants' published specification).

The attached Table A obtained by Applicants shows the diffraction efficiency of -1st order diffracted light of a DVD/CD compatible lens having only a blaze-shaped diffractive structure having a blazed wavelength of 720nm. As shown in Table A, at a wavelength of 655nm, the diffraction efficiency is 95% or more, and at a wavelength of 755nm, the diffraction efficiency is also 95% or more. Further, as shown in Table A, in the case that $\lambda 1$ is about 655nm and $\lambda 2$ is about 780nm, such as with a DVD/CD compatible lens, even if only a single blaze-shaped diffractive structure is used, the high diffraction efficiencies of $\lambda 1$ and $\lambda 2$ can be obtained. However, in case when the wavelength $\lambda 1$ satisfies: $370 \text{ nm} \leq \lambda 1 \leq 430 \text{ nm}$, while $\lambda 2$ is still about 655nm, when only a single blaze-shaped diffractive structure is used, it is difficult to obtain high diffraction efficiencies of both of $\lambda 1$ and $\lambda 2$, as is described above with reference to Fig. 8 of Applicants' specification.

Applicants' Fig. 4 shows a graph of the diffraction efficiency at $\lambda 1$ having a wavelength of 400nm which satisfies $370 \text{ nm} \leq \lambda 1 \leq 430$ when "the optical path difference giving structure is superimposed on the diffractive structure so that at least one stepped shape of the optical path difference giving structure is disposed on the optical surfaces of each of the plurality of diffracting ring-shaped zones. As shown in FIG. 4, the diffraction efficiency of -1st order diffracted light is 80% or more and the high diffraction efficiency can be obtained at a wavelength of 400nm and at a wavelength of 655nm. In other words, the above-described diffraction efficiency problem is solved by the structure recited in Applicants' invention.

Independent claim 1 is amended to recite an optical element of an optical pickup device that includes, inter alia, "an optical surface comprising a central region arranged around the optical axis and formed in an approximately circular shape, and a peripheral region arranged at a periphery of the central region", "a diffractive structure having a plurality of diffracting ring-shaped zones arranged around an optical axis on at least one optical surface, the diffractive

structure being provided in the central region", and "an optical path difference giving structure for giving a prescribed optical path difference to a prescribed light beam passing through the diffracting ring-shaped zones, the optical path difference giving structure being provided in the central region, wherein the first wavelength $\lambda 1$ satisfies: 370 nm $\leq \lambda 1 \leq$ 430 nm", "wherein the optical path difference giving structure is superimposed on the diffractive structure so that at least one stepped shape of the optical path difference giving structure is disposed on the optical surfaces of each of the plurality of diffracting ring-shaped zones". Support for these amendments can be found in original claims 9 and 15, and Fig. 2 of Applicants' published specification.

Ota and Shimano, whether taken alone or in combination, fail to teach or suggest "wherein the first wavelength $\lambda 1$ satisfies: 370 nm $\leq \lambda 1 \leq$ 430 nm", and "wherein the optical path difference giving structure is superimposed on the diffractive structure so that at least one stepped shape of the optical path difference giving structure is disposed on the optical surfaces of each of the plurality of diffracting ring-shaped zones" as recited in Applicants' amended claim 1.

Ota discloses an objective lens that is used for recording and/or reproducing information for two types of information recording media (CD and DVD). As shown in the attached Fig. B (labeled Fig. 1 of Ota), in the objective lens of Ota, areas that do not include a diffractive structure (i.e., areas having refractive surfaces) are provided on one optical surface to sandwich an area that does include a diffractive structure. The objective lens 10 of Ota includes a refracting (i.e., not diffractive) interface 11, a diffractive ring-shaped zone 13, and a refracting (i.e., not diffractive) interface 12 (see Fig. 1; and col. 22, lines 19-31 of Ota). The objective lens 10 of Ota further includes a step portion 13a that is disposed only at the boundary between the refracting interface 11 and diffractive ring-shaped zone 13 (see col. 23, lines 25-26 of Ota).

Light passing through the refracting interfaces 11, 12 of Ota suffers significantly less loss than the light passing through the diffractive ring-shaped zone 13 (see col. 22, lines 44-52 of Ota).

By providing the step portion 13a at the boundary between the refracting interface 11 and diffractive ring-shaped zone 13, as shown in Fig. 1 of Ota, the phase shift between the light flux passing though the refracting interface 11 and diffractive ring-shaped zone 13 is suppressed (see col. 23, lines 25-42 of Ota). By providing the step portion 23a at the boundary between the refracting interface 22 and diffractive ring-shaped zone 23 as shown in Fig. 6 of Ota the Strehl ratio is enhanced (see col. 23, line 66 to col. 24, line 1 of Ota).

Since Ota discloses that a step is arranged at that boundary between the diffractive zone 13 and the refracting interface 11, Ota fails to teach or suggest "wherein the optical path difference giving structure is superimposed on the diffractive structure so that at least one stepped shape of the optical path difference giving structure is disposed on the optical surfaces of each of the plurality of diffracting ring-shaped zones" as recited in Applicants' amended claim 1.

Further, the Examiner concedes that Ota mentions nothing regarding the first wavelength $\lambda 1$ satisfies: 370 nm $\leq \lambda 1 \leq$ 430 nm. However, the Examiner asserts that this wavelength range is known to those skilled in the art.

As discussed in detail above, in the case that $\lambda 1$ is about 655nm and $\lambda 2$ is about 680nm, such as with a DVD/CD compatible lens, if only a single blaze-shaped diffractive structure is used, the high diffraction efficiencies of $\lambda 1$ and $\lambda 2$ can be obtained. However, in case when the wavelength $\lambda 1$ satisfies: 370 nm $\leq \lambda 1 \leq$ 430 nm, while $\lambda 2$ is still about 680nm, when only a single blaze-shaped diffractive structure is used, it is difficult to obtain high diffraction efficiencies of both of $\lambda 1$ and $\lambda 2$.

Ota is not concerned with maintaining a high diffraction efficiency for both $\lambda 1$ and $\lambda 2$ in the case when the wavelength λl satisfies: 370 nm $\leq \lambda 1 \leq$ 430 nm, while $\lambda 2$ is still about 680nm. Further, although the wavelength range of 370 nm $\leq \lambda 1 \leq$ 430 nm is known in the art, maintaining a high diffraction efficiency for both $\lambda 1$ and $\lambda 2$ in case when the wavelength λl satisfies: 370 nm $\leq \lambda 1 \leq$ 430 nm and $\lambda 2$ is still about 680nm is not known to those skilled in the art.

Shimano discloses an optical disk apparatus to perform either reproduction or reproduction/recording of each of at least two kinds of optical disks having different substrate thicknesses. According to Shimano, to permit reproduction of a CD-R and the reproduction of a DVD in a compatible manner, both the aberration introduced by a substrate of a DVD having a 0.6 mm thickness and the aberration introduced by a substrate of a CD having a 1.2 mm thickness are reduced by a lens shape design where corresponding substrate thicknesses of the inner and outer regions of the objective lens are made different, a protruding circular phase shifter is provided on the inner region of the lens, and an annular phase shifter is provided in a verge of the inner region of the lens (see Abstract of Shimano).

The Examiner cites Fig. 34 of Shimano as teaching an optical path difference giving structure superimposed on a diffractive structure so that at least one stepped shape of the optical path difference giving structure is disposed inside the boundary of the optical surface of at least one of the plurality of diffracting zones.

As shown in the attached Fig. C (labeled Fig. 34 of Shimano), the lens of Shimano only includes a single diffractive structure. There is no optical path difference giving structure shown in the lens of Shimano. Further, the lens of Shimano unequivocally fails to show that an optical path difference giving structure is superimposed on the diffractive structure so that at least one

stepped shape of the optical path difference giving structure is disposed on the optical surfaces of each of the plurality of diffracting ring-shaped zones, as recited in Applicants' amended claim 1.

Further, the Examiner concedes that Shimano mention nothing regarding the first wavelength $\lambda 1$ satisfies: 370 nm $\leq \lambda 1 \leq$ 430 nm. However, the Examiner asserts that this wavelength range is known to those skilled in the art.

As discussed in detail above, in the case that $\lambda 1$ is about 655nm and $\lambda 2$ is about 680nm, such as with a DVD/CD compatible lens, if only a single blaze-shaped diffractive structure is used, the high diffraction efficiencies of $\lambda 1$ and $\lambda 2$ can be obtained. However, in case when the wavelength $\lambda 1$ satisfies: 370 nm $\leq \lambda 1 \leq$ 430 nm, while $\lambda 2$ is still about 680nm, when only a single blaze-shaped diffractive structure is used, it is difficult to obtain high diffraction efficiencies of both of $\lambda 1$ and $\lambda 2$.

Shimano is not concerned with maintaining a high diffraction efficiency for both $\lambda 1$ and $\lambda 2$ in the case when the wavelength $\lambda 1$ satisfies: 370 nm $\leq \lambda 1 \leq$ 430 nm, while $\lambda 2$ is still about 680nm. Further, although the wavelength range of 370 nm $\leq \lambda 1 \leq$ 430 nm is known in the art, maintaining a high diffraction efficiency for both $\lambda 1$ and $\lambda 2$ in case when the wavelength $\lambda 1$ satisfies: 370 nm $\leq \lambda 1 \leq$ 430 nm and $\lambda 2$ is still about 680nm is not known to those skilled in the art.

In view of the foregoing, Applicants submit that Ota and Shimano, whether taken alone or in combination, fail to teach or suggest the subject matter recited in Applicants' amended independent claim 1. Accordingly, claim 1 is deemed to be patentable over Ota and Shimano under 35 U.S.C. §103(a).

Independent claim 36 has been amended to recite limitations similar to claim 1 and is, therefore, deemed to be patentably distinct over Ota and Shimano for at least those reasons discussed above with respect to independent claim 1.

Claims 17-20, 34, 35, 38, 39, 41, 43, 44, and 47 have been canceled. Claims 2-16, 21, 27-33, 37, 40, 42, 45, and 46, which depend from independent claims 1 and 36, incorporate all of the limitations of the respective independent claim and are, therefore, deemed to be patentably distinct over Ota for at least those reasons discussed above with respect to independent claims 1 and 36.

Conclusion

In view of the foregoing, reconsideration and withdrawal of all rejections, and allowance of all pending claims is respectfully solicited.

Should the Examiner have any comments, questions, suggestions, or objections, the Examiner is respectfully requested to telephone the undersigned in order to facilitate reaching a resolution of any outstanding issues.

Respectfully submitted,
COHEN PONTANI LIEBERMAN & PAVANE LLP

By _____

Alfred W. Froebrich
Reg. No. 38,887
551 Fifth Avenue, Suite 1210
New York, New York 10176
(212) 687-2770

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